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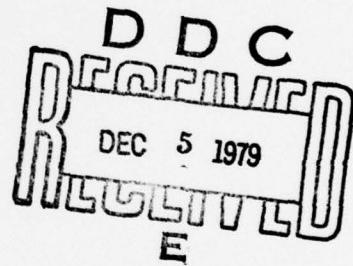
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October 1979



William C. Mann

Dialogue Games



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Natural dialogue does not proceed haphazardly; it has an easily recognized "episodic" structure and coherence that conform to a well developed set of conventions. This report represents these conventions formally in terms related to speech act theory and to a theory of action.

The major formal unit, the Dialogue Game, specifies aspects of the communication of both participants in a dialogue. We define the formal notion of Dialogue Games and describe some of the important Games of English. Dialogue Games are conventions of interactive goal pursuit. Using them, each participant pursues his own goals in a way that sometimes serves the goals of the other. The idea of Dialogue Games can thus be seen as a part of a broader theoretical perspective characterizing virtually all communication as goal pursuit activity.

We also define and exemplify the property of Motivational Coherence of dialogues. Motivational coherence can be used as an interpretive principle in explaining language comprehension.

Actual dialogue games have a kind of causal connectedness that is not a consequence of their formal properties. This is explained in terms of a theory of action, which is also seen to explain a similar attribute of speech acts.

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**Dialogue Games**

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## ABSTRACT

Natural dialogue does not proceed haphazardly; it has an easily recognized "episodic" structure and coherence that conform to a well developed set of conventions. This report represents these conventions formally in terms related to speech act theory and to a theory of action.

The major formal unit, the Dialogue Game, specifies aspects of the communication of both participants in a dialogue. We define the formal notion of Dialogue Games and describe some of the important Games of English. Dialogue Games are conventions of interactive goal pursuit. Using them, each participant pursues his own goals in a way that sometimes serves the goals of the other. The idea of Dialogue Games can thus be seen as a part of a broader theoretical perspective characterizing virtually all communication as goal pursuit activity.

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An earlier draft of this report was submitted in December, 1978, to be part of the forthcoming book *Models of Dialogue*, J. Hintikka, et al. (eds.).

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## 1.0 INTRODUCTION

Dialogue games are abstract elements of a theory of the discourse structure of human dialogue. They are bilateral, in the sense that each dialogue game refers to and accounts for aspects of the speech of both parties to a dialogue. (The generalization of dialogue game theory to multilogue appears to be straightforward. There are also some interesting ways to use dialogue games to account for monologue structures. However, both of these are outside of the scope of this report.)<sup>1</sup>

A dialogue text reflects intentions and goal pursuit activity on the part of each participant. Dialogue proceeds in a manner which not only leaves traces of this goal pursuit, but also exhibits it to the participants. That is, each speaker provides suitable information so that the hearer can have tacit knowledge of a plausible set of goals that the speaker can be seen as pursuing. Some goals are pursued merely because achieving them contributes to achieving some other goal(s); goals subordinated in this way are referred to as subgoals. Other goals are not subordinated. The subordination relationships between a speaker's goals and their subgoals are part of the hearer's tacit knowledge.

The particular goals that a speaker exhibits in dialogue are consequential over the period in which he is evidently pursuing them. They can conveniently be regarded as having scopes, intervals over which they prevail in particular ways. Without reviewing the evidence, it is clear that the consequences include effects on pronoun resolution and related syntactic consequences, semantic effects including certain kinds of restriction of generic terms, and pragmatic effects such as the creation or prohibition of certain indirect speech act interpretations of utterances, and also creation of topic boundaries perceived by hearers but not overtly signaled in the dialogue. It is also clear that the effects of exhibited goals are a significant component of what is often vaguely called "context."

<sup>1</sup>Constructs called Dialogue Games were defined as part of the design of a comprehension system called DMS [Levin 77, Mann 77a, Mann 77b].

It is timely to restate the theory of dialogue games for several reasons. It needs to be clarified, partly because previous descriptions of dialogue games were intermixed with computer system design descriptions and discussion of other concepts, but more because we can now make the relationship of dialogue game theory to speech act theory very explicit. We also wish to correct an unfortunate tendency to confuse dialogue games with certain other notions, especially scripts and frames. Finally, a restatement is now needed as a working tool in our development of a new dialogue comprehension system to be called DCS.

Dialogue Game theory arose during attempts to create a thoroughly explicit theoretical framework for accounting for natural language comprehension. Explicitness was to be enforced by representing all of the claims of the theory by computational processes, and relevance was to be enhanced by choosing natural dialogues as data. Creation of such a framework clearly has not been achieved, but the general research strategy is still being pursued.

The use of the term "games" here was inspired by certain resemblances to Wittgenstein's language games, but its use here does not conform to his.

We gratefully acknowledge support from the National Science Foundation, grants MCS78-07410 and MCS76-07332, and from ARPA contract N00014-75-C-0710. We also gratefully acknowledge the important contributions that Levin and Moore have made to this development.

How does a speaker "exhibit" a goal? Roughly, a goal is exhibited in the interval in a dialogue from the first point at which the speaker first communicates that he is pursuing the goal to the point at which the speaker communicates that he has stopped pursuing the goal. We are therefore concerned both with the event of a speaker communicating onset of pursuit of a goal and the event of a speaker communicating the cessation of pursuit of a goal, possibly separated by one or more turns.

There are two principal mechanisms a speaker may use to communicate the onset of pursuit of a goal. He may assert directly that he holds a goal, as in

"I want to know why the sky is brown."

or he may perform some speech act for which holding a goal is a felicity condition, as in

"Tell me why the sky is brown."

Actually, the direct assertion of a goal has as a felicity condition that the speaker holds the goal, so these two mechanisms really have a single description, that is, a speaker exhibits a goal by performing a speech act for which holding the goal is a felicity condition.

For cessation, the case is parallel but less obvious, as this report shows. The theory of Dialogue Games here includes extensions to speech act theory, accounting for onset and cessation of speakers' goals.

Although some speakers' goals are formed and evidenced in novel ways, there are also conventions of goal use. In particular, there are conventional combinations of goals and related propositions used repeatedly by dialogue participants. The ability to recognize and employ these conventions is part of a person's communicative competence. Dialogue games are abstract technical descriptions of these conventions. The conventions are described formally in the next two sections, the first devoted to propositional knowledge and the second to the active use of that knowledge.

## 2.0 ELEMENTS OF DIALOGUE GAMES

### 2.1 Dialogues and Turns

For the purposes of this definition, we consider only the case of alternating dialogue, dialogue that (in the views of the participants, if not in fact) can be represented by a sequence of two or more intervals of language use produced alternately by the participants, without significant overlap in time. Each element of such a sequence is produced by a single speaker and bounded either by the other

speaker's language use, or by the beginning or end of the sequence.<sup>2</sup> Each such element is called a *turn*, and the sequence is called a *dialogue*.

This definition is meant to apply only to communication taking place through media that do not impose significant delays between turns. Thus face-to-face dialogue, radio conversations and linked typewriter dialogues are included, but exchanges of letters are not.

## 2.2 Participants

One participant is designated I (for Initiator) and the other R (for Responder); participants are also designated without regard to these roles as A and B.

## 2.3 Goals

Each participant has a view or model of the world, and in this view the world may assume various states. States and sets of states of the world are subject to description. Let DA be such a description in the view of A. Then "A wants DA" is a goal. (For present purposes, it is convenient to regard "wants" as a predicate; for other purposes one would prefer more than two possible values.)

The describable world of A includes participant B, whose state may be described in various ways. Goals of A can therefore contemplate *descriptions of states of B which A desires to prevail, including goals to be held and pursued by B, knowledge for B to possess or actions for B to perform*.

## 2.4 Formal Definition of Dialogue Games

A dialogue game is a triple, (IP, GR, CC), consisting of

IP: A goal in the view of I called the *illocutionary point* of the game.

GR: A non-empty set of goals called *goals-of-R*.

CC: A set of state descriptions in the view of I called the *conventional conditions* of the game.

## 2.5 Examples of Dialogue Games

Table 1 below represents some of the dialogue games of American English. (The table could be extended, say, with definitions of an information offering game or others.)

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<sup>2</sup>The terms speaker and hearer are used regardless of whether the media of communication include an auditory one.

Each game has a single goal as its illocutionary point. This restriction to a single goal has been adopted on empirical grounds. In attempting to construct appropriate games to fit a wide variety of actual dialogues, we have never felt a need to construct a game with multiple goals for the initiator.

## 2.6 Standard Conventional Conditions

The representations of dialogue games in Table 1 have been abbreviated by omission of certain conventional conditions common to all dialogue games. These conditions are expansions of the following expressions:

1. I is pursuing the illocutionary point as a goal.
2. I believes that achieving the illocutionary point is feasible.
3. I believes that R's achieving the goals-of-R is feasible.
4. I has the right to achieve the illocutionary point.
5. I has the right to use the dialogue game.
6. The illocutionary point has not already been achieved.
7. R is willing to pursue the goals-of-R.

## 3.0 USES OF DIALOGUE GAMES

The simple synthetic example in Fig. 1 below is representative of the domain of discourses to which dialogue game theory should apply. The participants are a mother M and child C.

What kinds of knowledge about this dialogue do we account for? Whatever phenomena there are, in whatever description, they must be defined relative to human judgments about the text. Some of the judgments made about this text appear in the right hand column of the figure. Many more could be made, but these particular judgments are ones that dialogue games are helpful in explaining.

## 4.0 ENTERING AND LEAVING DIALOGUE GAMES

### 4.1 Entering Dialogue Games

We notice in the example in Fig. 1 an "episode" starting with turn 11 and ending with turn 14, devoted to getting permission to eat.

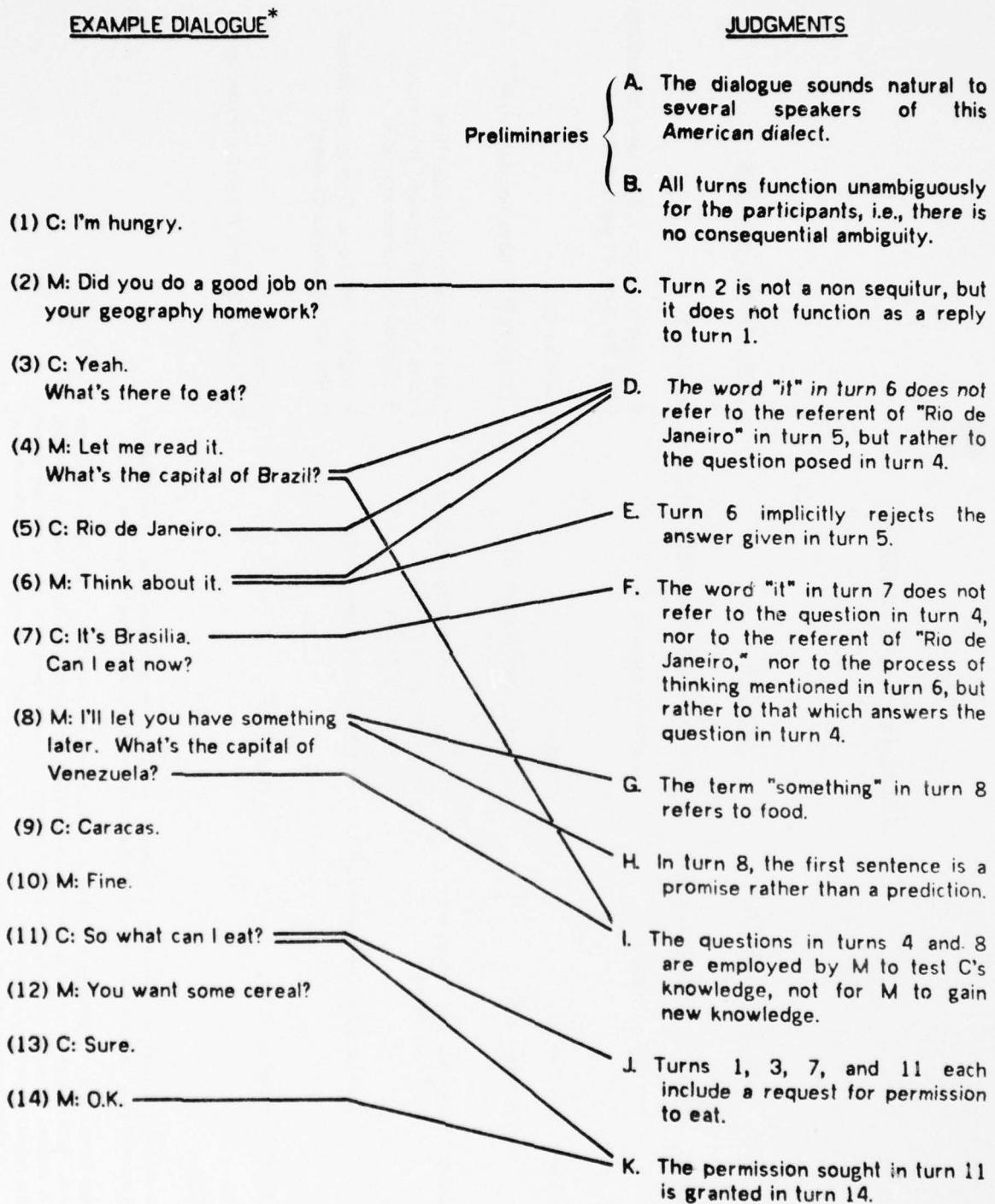
Before describing any new account of such episodes, we should note that speech act theory does not already provide such an account. In usual speech act

Table 1  
SOME DIALOGUE GAMES\*

<u>Game</u>	<u>Ilocutionary Point</u>	<u>Goals-of-R</u>	<u>Conventional Conditions</u>
<b>Information Probing</b>	I knows whether R knows Q.*	R informs I of R's knowledge of Q.	I knows Q.
<b>Helping</b>	I is able to perform A.	I is able to perform A.	R is able to cause I to be able to perform A; I has the right to perform A.
<b>Information Seeking</b>	I knows Q.	I knows Q.	R knows Q.
<b>Dispute</b>	R believes P.	R justifies that R might not believe P.	I believes P; R does not believe P.**
<b>Permission Seeking</b>	I knows that R approves that I performs A.	(R chooses whether to approve that I performs A) and (I knows this choice).	I wants to perform A sometime; I does not have the right to perform A without the permission of R.
<b>Action Seeking</b>	R causes A to be performed.	R causes A to be performed.	R might not cause A to be performed in the normal course of events.
<b>Information Offering</b>	R knows P.	R knows P.	I knows P; R's knowledge and P can be reconciled.

\*In these game specifications A represents an action, Q represents an information specification, and P represents a proposition. They are unspecified in the game definitions, but must be made suitably definite when the game is used.

\*\*Although the Dispute Game carries the assumption that I believes the proposition which he defends, he can explicitly deny that he believes it. Such a denial does not destroy an ongoing dispute, but rather alters its working hypotheses, making it more like a debate. In some circumstances, (e.g., debates, academic discussions or "devil's advocate" defenses) such a denial would be wholly redundant. The assumption is therefore optional, a convention rather than a consequence of other facts about the communication situations of disputes.



\*This is a synthetic dialogue which has been composed to illustrate the operations and structures discussed in this paper. However, use of such dialogues is not representative of our usual methods of inquiry. Synthetic dialogues (including plays and dialogues which people produce while pretending) usually differ from natural dialogues under dialogue game analysis. Results established only on the basis of nonnatural dialogues are suspect.

Figure 1. Example Dialogue and Judgments.

theory, speech acts are performed by utterances, and the given examples of utterances are all sentences. Utterances are contiguous sequences of linguistic objects, and each utterance has a single speaker. (The identification of utterances with sentences should probably be relaxed, so that such constructs as multisentential offers would be recognized as having the same speech act status as single sentence offers. However, even if this were done, utterances would still be contiguous sequences having a single speaker.) They are thus prohibited from spanning multiple turns of a dialogue, and so cannot be used to account for episodic structures such as the one in turns 11 through 14.

The adjacent pair of turns has also been used as a unit of analysis by some, notably ethnomethodologists Sacks and Schegloff. Notice that it is also inherently inappropriate for accounting for any phenomenon spanning more than two turns.

Notice also that it is likely that speech act theory will have to be extended to describe some multi-utterance and even multi-turn sequences of speech acts. Such a development will be necessary if answering a question is to be regarded as a speech act comparable to asking a question. "What counts as an answer?" has received much less attention than "What counts as a question?"

However, it is clear that one often begins to answer, continues to answer, and finishes answering in distinguishable ways, using multiple sentences and (in dialogue) in multiple turns. The whole span of utterances from beginning to finishing counts as the answer. So, even for this part of the domain of speech act theory, notions of acts performed by means of multiple utterances seem necessary.

We account for our example episode (turns 11 through 14) as the speaker C initiating use of the Permission Seeking game, with the game remaining in use until the illocutionary point was achieved in turn 14.

The duration of use of the Permission Seeking game (and all other games) varies. Each participant may perform many different speech acts, in the sense of Searle and others, in the course of the game's use [Austin 62, Searle 69, Searle 75]. However, no explanation of the individual speech acts accounts for the fact that the participants recognize and take advantage of such episodic structure, so that, for example, both are responsive to the fact that the issue raised in turn 11 is still open at the end of turn 13.

To account for entry, we posit a speech act called a *bid of a game*. The participant who bids a game is identified with I in the game specifications, and the other with R. Bidding a game is, among other things,

1. to offer to pursue the illocutionary point in the game specification, including in particular the *illocutionary point* of the game.

2. to request that R begin to pursue the goals-of-R in the game specification. (The illocutionary point and the goals-of-R must be made suitably definite in the bid. In all of the specified games, this is accomplished by simply making the illocutionary point definite.)
3. to offer to adopt the conventional conditions of the game as working hypotheses for the duration of the game's use (or until some other hypotheses replace them). Adopting the conventional conditions as working hypotheses is very much like presupposing them. The conventional conditions are propositions; they are overt rather than private; they are implicit rather than explicit; and the hearer is justified in regarding the speaker as assuming them. As such they function like felicity conditions of standard speech act theory, but over the entire interval of the game's use rather than just on a single utterance.

Bidding a dialogue game prompts for a response, just as do requests, queries and certain other speech acts. As part of the account of this response, we recognize a speech act of *acceptance of a bid*, performed of course by R.<sup>3</sup> To be performed felicitously, there must be a corresponding prior bid by I that has not already received a response. The act of acceptance of a bid resembles speech acts of acceptance of offers. If I bids a game, and R accepts the bid, then the game has been entered, and both parties are free to rely on the conventional conditions thus established as working hypotheses.<sup>4</sup>

The goals of I and R are regarded as being actively pursued for the duration of the game.

Why have the speech acts of *bid of a game* and *acceptance of a bid* not been included in previous speech act theory? Obviously it was necessary first to recognize the existence of games and also to identify the fact that entering and leaving their scopes (see section 4.4 below) were actions. Identification of these speech acts has also surely been hampered by the fact that the *bidding of games and acceptance of them are usually performed implicitly, as indirect speech acts*. For example, consider a dialogue that begins with a factual statement,

<sup>3</sup>For these speech acts, as for all of the speech acts discussed in this report, an utterance counts as performance of a particular act by being publicly recognizable as such. The theory is a theory of the consensus of observers of utterances. It may be that the actual participants will not both agree with the consensus. The teacher may say, "In asking Q I was not attempting to test your knowledge." Nevertheless, the jury of observers may agree that Q counts as a bid of the Information Probe game.

I take this to be the dominant view of speech act theorists toward standard speech acts, so that "What counts as a question?" may be paraphrased roughly as "What counts as a question in the view of a large proportion of qualified observers?" The case of the newly defined acts in this report is no different, except that since the names of the acts are unfamiliar, their definitions must be the basis of any consensus.

<sup>4</sup>In some social circumstances, especially when the dialogue participants are not peers, acceptance of a bid may not be required. So, for example, in a dialogue between master and slave a game could be entered without the slave's performing an acceptance of the bid.

(15) A: I can't start my car.

In this position it not only functions as a statement about the speaker and the car, but may also perform a bid of the helping game. Notice that it does not mention help explicitly, nor request the other party's participation. But without the possibility of cooperative response, it would be unmotivated. R, in ascribing motivation (goals) to A, should readily recognize (15) as a request for help. Notice that this method of bidding resembles the recognized method for performing indirect speech acts in which an action is requested by asserting one of its preconditions [Heringer 72]. Here, one of the conventional conditions (from number 6 of the standard conventional conditions) is asserted, namely:

I is not able to perform A.

Almost any part of a game definition can be used to create a bid. Further discussion of the great diversity of ways to bid games is found in the previous work on the subject [Mann 75a, Mann 77a, Levin 77, Mann 77b].

The act of acceptance of the bid can likewise be performed implicitly, as in the following reply to (15):

(16) B: Did you buy gas at Cheapgas?

This is presumably an act of acceptance of the bid because by initiating diagnosis of the problem, B begins to pursue the goal offered. It is recognizable as acceptance because it obviously can contribute to satisfaction of the illocutionary point of the game, namely, to become able to start the car. The act of acceptance of a bid of a game is distinguished from acts of acceptance of other offers in two ways:

1. Acceptance of a bid of a game has immediate consequences for both parties in extending the dialogue, whereas other acceptances may have only delayed effects.
2. The most frequent kind of act of acceptance, beginning pursuit of certain goals, has not been given theoretical status in speech act theory as an act of acceptance for the other offers.

However, it may be that theories of discourse will assimilate these acceptances to others.

Acceptance of a bid is like acts of acceptance of offers in general, in that both sorts of acts lead to an expectation that the offer will be fulfilled. Acceptance of a bid is to be distinguished from "uptake" (as described in [Stalnaker 76, Rogers 78]); this can be seen in the following variant of the previous dialogue:

(17) A: I can't get my car started.

(18) B: I'm very busy right now. Ask me again tomorrow if you need to.

In (17), the Helping game is bid, and there is no objection in (18) to any aspect of its validity as a bid. Full uptake of the bid is achieved; however, the bid is not accepted. The turn in (18) rejects the bid, and so the Helping game is not entered.

#### 4.2 Leaving Dialogue Games

Somewhat parallel to the acts for entering, we posit an act for leaving, called *bidding termination of a game*. Bidding termination is also often done implicitly. If a particular utterance makes it evident that the illocutionary point is unpursuable, then that utterance functions as a bid for termination. The illocutionary point may become unpursuable by satisfaction, as when the speech appears to supply requested information, or it may become unpursuable by infeasibility, as for example by exhausting the available methods which address that goal.

When several games are ongoing, it is possible (and frequent) for a bid of termination to address a game that is not the one most recently entered. For example, the illocutionary point of the most recently entered game may be a subgoal of some higher goal, itself the illocutionary point of an ongoing game. If an utterance shows the higher goal to be satisfied or unpursuable, then termination of that higher game, along with termination of all of the games entered after entering that higher game, is being bid.

The previously defined act of acceptance of a bid seems adequate for use both to enter and to leave a game. Acceptance of a bid of termination terminates the particular use of the game and has the additional effect of terminating all of the other ongoing dialogue game uses that began within the scope of the game being terminated. This ensures *strict nesting of game uses*, an arrangement found in all but a few extremely bizarre examples.

#### 4.3 Refusal of a Bid

Finally, we posit a speech act of *refusal of a bid*. This act typically occurs in the turn immediately following a bid. Like bidding and accepting, refusing a bid is often performed implicitly, sometimes by pursuing a goal unrelated to the illocutionary point of the game being bid or, in the case of refusal of a bid of termination, by continuing to pursue the illocutionary point of the game.

Although all of the game-related speech acts are often performed implicitly, they may all be performed explicitly as well. It is conceivable that bids will be neither immediately accepted nor immediately refused, but rather that some negotiation will take place leading to acceptance or refusal. However, I am reluctant to synthesize such an example, since (after examining hundreds of natural dialogues) I have no natural examples of this.

Bids of games which are accepted are called *successful bids*, and bids which are refused are called *unsuccessful bids*.

#### 4.4 Scopes of Use of Games

For a dialogue game G, a *scope of use* of G (or simply a *use* of G) is a sequence of utterances that

1. begins with a successful bid of G, and
2. is immediately followed by either an acceptance of a bid of termination of G or the end of the dialogue.

Two features of this definition are noteworthy. First, requiring that the bid be successful forces every scope of use to include turns by both participants. Second, by defining scope of use so that the acceptance of a bid of termination is *outside* of the scope, the scopes so defined closely match scopes assigned by readers who are asked to mark the intervals in dialogue where particular topics are being discussed [Mann 75b, Mann 77c]. Scopes of use almost always coincide with the major "episodic" structures that people recognize intuitively in dialogue. They are also closely related to the distribution of "focus spaces" [Grosz 77].

The illocutionary point of a particular scope of use is the one established in the bid of the game beginning that scope of use, and the bid beginning the scope of use is called the *opening bid* of that scope. A scope of use is *open* at turn T if no successful bid of termination of that scope has been performed prior to T.

Note that dialogue game uses can be recursive, and in fact we often find a scope of use of the information-seeking game that includes one or more other scopes of use of the same game.

Note also that these conventions permit a more detailed description of a variety of mistakes and anomalies of communication. People sometimes ignore a bid, accidentally or deliberately. This may be taken as an act of rejection of the bid, whether or not any such act was intended. A bid of one game may be taken to be a bid of another, such as a bid of the Information Probe game being taken as a bid of the Information Seeking game. Failure to recognize a bid of termination can lead to a specific kind of confusion about the relevance of later utterances, namely that they are mistakenly taken to be spoken in pursuit of a goal whose pursuit has been abandoned.

## 5.0 MOTIVATIONAL COHERENCE OF DIALOGUES

To the above descriptions of dialogue games and their uses we add a principle that governs the relationship between uses of dialogue games.

Let  $B$  be a bid of a game, the bid being performed in turn  $T$ .  $B$  bears on a scope of use  $S$  iff:

1.  $S$  is open at  $T$ , and
2.  $T$  does not bid termination of  $S$ .

A bid of a game  $B$  is *motivationally compatible* with its context iff, for each scope of use  $S_i$  such that  $B$  bears on  $S_i$ , the illocutionary point of  $B$  Serves the illocutionary point of  $S_i$ .<sup>5</sup>

Note that with a suitable (predictive) notion of "Serves," the hearer can immediately judge whether a bid is motivationally compatible with the context in which it occurs. His judgment can be made as soon as he knows the illocutionary point of the bid.

A dialogue is *motivationally coherent* iff every bid of a game it contains is motivationally compatible with its context.

We have found nearly all of the natural dialogues that we have examined in detail to be motivationally coherent. There is also a preference for motivationally compatible interpretations, so that, given two interpretations of a particular turn in a dialogue, one of which is motivationally compatible with its context and one of which is not, people select the compatible interpretation as the correct one. A turn that can be interpreted only in ways not motivationally coherent is seen as a *non sequitur*. People are frequently willing to create very imaginative explanations in order to preserve motivational coherence.

We can therefore use the notion of motivational coherence as part of an explanation of language comprehension. It provides a system of constraints on acceptable interpretations, in some ways directly analogous to familiar kinds of semantic and syntactic constraints. Like other kinds of constraints, motivational coherence has a great deal of explanatory power, in spite of the fact that it is occasionally violated in practice.<sup>6</sup>

Figure 2 summarizes our analysis of the example dialogue. There are four scopes of use that we can judge for motivational compatibility. We judge all of them to be compatible, and so the dialogue as a whole is motivationally coherent.

<sup>5</sup>See the section on theory of action, 6.2, for a discussion of "Serves."

<sup>6</sup>There are comparable principles of motivational coherence that could be applied to the nonbidding utterances in dialogue, and also to monologue text. These are anticipated less formally in some methods of exegesis and text criticism; the discussion of these is of course outside the scope of this report.

(Notice that the scope of use beginning in turn 7 is motivationally compatible with its context even though the goal of eating does not serve the goal of knowing whether C did a good job on the geography homework, because termination of the open scope is bid in the same turn.)

The dialogue contains examples of nested use of dialogue games (turns 2 through 10 and turns 11 through 14), implicit acceptance of bids (turns 5 and 12), refusal of game bids (turn 2), refusal of a bid of termination of a game (turns 4,8), and disambiguation of game bids (as Information Probing rather than Information Seeking in turns 4 and 9, vice versa in turn 11) by the principle of motivational coherence. It also contains an example of semantic specification of a generic term ("something") based on a current goal introduced through use of a game.

## 6.0 RELATING DIALOGUE GAMES TO OTHER THEORIES

### 6.1 Speech Acts

We have made direct use of speech act theory in this formulation of dialogue game theory. The representation of bidding, acceptance and rejection of bids, and the choice of the term "illocutionary point" are intended to suggest some of the close relationships between dialogue game theory and speech act theory.

Speech acts are *unilateral*. They are performed in their entirety in contiguous speech by a single speaker. In contrast, Dialogue Games are *inherently bilateral*. Scopes of use of dialogue games must include turns by both participants. Dialogue games are in a sense the *lowest level bilateral construct*, since they rely entirely on unilateral constructs. Whereas a speech act specification accounts for an action by a single speaker, along with its conditions, dialogue games account for particular actual effects of a speaker's words on a hearer. So, for example, as a hearer is moved to accept or reject a bid, he utters words that reveal the effect of the bid, including the particular effect of the prior utterance having been recognized as a bid. Thus we see dialogue game theory is a theory of communication in a way that speech act theory is not. It accounts for actual effects of speech on hearers, changes of state brought about by exchange of symbols. Since dialogue games are the lowest level bilateral construct in this definitional hierarchy, they are in a sense a *minimal theory of communication*. The principle of Motivational Coherence, on the other hand, is defined relative to the illocutionary points of dialogue games and so is not minimal in the same sense.

#### 6.1.1 Special Status of Questions

Unlike most game bids, questions (interrogatives) in their most common interactive use are *direct speech acts*. They bid various games, notably Information Seeking and Information Probing. In other words, we identify the act of questioning and the bidding of a particular game as the same act. What counts as a suitable answer clearly varies with the dialogue game, so identification of the

SCOPES OF USE	EXAMPLE DIALOGUE	ENTRY			TERMINATION		
		BIDS OF GAMES	REFUSALS OF BIDS	ACCEPT- ANCES OF BIDS	BIDS OF TERMIN- ATION	REFUSALS OF BIDS	ACCEPT- ANCES OF BIDS
	(1) C: I'm hungry.	Permission seek					
	(2) M: Did you do a good job on your geography homework?	Information seek					
	(3) C: Yeah. What's there to eat?	Permission seek					
	(4) M: Let me read it. What's the capital of Brazil?	Information probe					
	(5) C: Rio de Janeiro.						
	(6) M: Think about it.						
	(7) C: It's Brasilia. Can I eat now?	Permission seek					
	(8) M: I'll let you have something later. What's the capital of Venezuela?	Information probe					
	(9) C: Caracas.						
	(10) M: Fine.						
	(11) C: So what can I eat?	Permission seek					
	(12) M: You want some cereal?	Information seek					
	(13) C: Sure.						
	(14) M: O.K.						

Figure 2. Game Related Speech Acts and Scopes of Use.

particular game being bid is consequential. For example, in the Information Probing game the goal of the tester (I) cannot be satisfied by having the testee (R) read the correct answer from a reference book. In general, what counts as an appropriate goal for I is constrained by situation and the prior text of the dialogue, making the bid unambiguous in most cases.

The familiar question-answer pair is often a particularly abbreviated case of using the information seeking game. In the dialogue

(19) A: Where's the towel?

(20) B: Behind you.

A bids the information seeking game in (19). In (20) B begins to pursue the proffered goal (that A knows where the towel is) and thereby accepts the bid. If B satisfies the goal, as in this case, he thereby bids termination of the game. Then unless A appears to continue to pursue his goal as in

(21) A: I don't see it.

or complains, as in

(22) A: I didn't hear you.

or

(23) A: No, the other one.

he has performed an acceptance of the bid of termination, and the game is thereby terminated.

Questions differ from imperatives in that when an imperative is given, there may be no goal that R can pursue by speaking, and in such cases no game is bid. There are also other roles for questions for which there is no corresponding goal that R can pursue by speaking, and such questions do not bid games.

## 6.2 Theory of Actions

Dialogue game theory depends on a general theory of actions, in more ways than speech act theory does. Such a theory must provide for states and state descriptions, goals of agents, and plans (i.e., goal subordination relationship, and goal/action relationship). These are treated in greater detail in [Mann 79]. In this theory of actions it must be possible to state what counts as pursuit of a particular goal and what counts as an unpursuable goal. This theory of pursuit is the source of the "Serves" relation that we have relied upon.

The principle of motivational coherence is seen above as a selective basis on which some interpretations of utterances are rejected. But how selective is it? To reject an interpretation of an utterance on the basis of motivational coherence, the goals that the utterance can serve must not include the goals already revealed by

prior text. If Goal1 is served by an utterance U (according to a particular interpretation), and Goal2 is a prevailing goal already revealed by S, then we must be able to deny that Goal1 Serves Goal2 if we are ever to reject this interpretation of U on the basis of lack of motivational coherence. Occurrence of pairs such as Goal1 and Goal2 will of course be a feature of some theories of action and not others. Since our experience indicates that some sort of motivational coherence does prevail in communication, we require that the theory of action provide for it. The theory *must not* contain ways to rationalize from any goal to any other, so that one would find that Goal1 Serves Goal2 for any pair of goals whatever. We prefer theories of action in which the "Serves" relation is quite sparse, since such theories agree with our observation that one must in fact act very selectively in order to pursue ordinary human goals.

While some portions of natural dialogue games are clearly arbitrary, other parts are simply consequences of the active nature of communication. We should expect to see various theories of action, differing in details, which are empirically adequate for explaining human communication actions.

Any adequate theory would be expected to explain several features of dialogue games as a matter of course. For example, it should explain why bidding a game always carries the working hypothesis that the illocutionary point has not already been achieved and also the hypothesis that achieving the illocutionary point is feasible (standard conventional conditions 6 and 2 respectively).

Such a theory need not be complex or obscure. There are straightforward theories of action in artificial intelligence and elsewhere that embody explicit formal concepts of acts, goals, preconditions, well-formed-plans and other constructs. Even without attempting to assess the adequacy of any of them, it is clear that there is a good prospect for finding a satisfactory one.

Part of the theory of actions will necessarily be psychological, accounting for the goals, plans, self-perceptions, etc., that people may hold. De Beaugrande has suggested ways to interpret actions in dialogue in terms of more or less permanent psychological goals [de Beaugrande 78].

### 6.3 Relation to Scripts and Frames

Scripts and frames, in Artificial Intelligence, are loosely defined concepts of knowledge structures containing collections of associated ideas, facts or propositions. The terms were popularized by Schank [Schank 75] and Minsky [Minsky 75] respectively. Winograd has pointed out that few if any explicit claims have been made about general consequences of their use and that whether a knowledge structure is a script or a frame is not a formal issue [Wilks 75, Winograd 75].

It would be inappropriate to call dialogue games "scripts" or "frames" because there are significant differences between the concept of a dialogue game as defined

above and the prevailing usage of the latter terms. The terms have been used most often to describe collections of knowledge about conditional sequences of events or collections of objects in the world, related by likelihood or frequency of occurrences, unlike dialogue games, which bear knowledge about conditions and consequences in interpersonal communication. Unlike typical scripts or frames, dialogue games do not embody knowledge about particular topics of conversation or expertise. The independence of dialogue game knowledge from so-called "domain knowledge" is an important factor since it is useful in explaining how people can converse freely on new subjects.

#### 7.0 IS THIS CONSTRUCT NECESSARY?

Dialogue games are convenient theoretical constructs, but there is an issue of whether such collections of knowledge need to be given any theoretical status at all. Could some other combination of constructs, perhaps already recognized ones, account for the same phenomena? In particular, is it the case that a combination of a theory of action, a speech act theory and some knowledge of the circumstances of dialogue will be sufficient to predict or reconstruct in context all the knowledge that dialogue games hold (or should hold)?

One kind of evidence concerns arbitrary, implicit communication which arises from the conventional conditions. Consider

(24) A: Who is the Secretary of Agriculture now?

(25) B: Why do you assume I would know that?

B's reply is an ordinary, legitimate response to A in many situations. The proposition that B knows the identity of the present Secretary of Agriculture is neither expressed nor presupposed by (24). It is an arbitrary convention of the Information Seeking game, represented by the proposition that R knows Q, in its conventional conditions.

Notice that we cannot associate the condition R knows Q with the direct speech act of the question in (24) since, for example, if the situation is an oral quiz, then in

(26) Teacher: Who is the Secretary of Agriculture now?

(27) Student: \*Why do you assume I would know that?

the reply is unacceptable. The Information Probing game is being bid in (26) rather than the Information Seeking game, and the Information Probing game has no such conventional condition.

**There are ways of using dialogue games in an altered form that also illustrate the arbitrary character of conventional conditions. One may say**

**(28) Excuse me, I don't know whether you know the answer to this,  
but I'd like to ask you who is Secretary of Agriculture now?**

in which the Information Seeking game is bid in an altered form. Such preparatory remarks are inappropriate if the question is bidding the Information Probing game, since its very point is to come to know whether the hearer knows the answer.

One can obviously seek information by engaging in dialogue; one can do so without ever using, as a working hypothesis, that the other participant knows the information being sought, i.e., without using any hypothesis like R knows Q. The occurrence of this conventional condition in the Information Seeking game (and its consequences in our experience) is an arbitrary element not dependent on the action being performed, the speech acts used, or communication circumstances. Therefore it is not derivable from the corresponding theories of action, speech acts, or circumstances. One must find another locus for this knowledge. The dialogue game seems to be the appropriate level of abstraction for representing the hypothesis.

## **8.0 WHAT KINDS OF GAMES OCCUR?**

Dialogue games are not simply arbitrary collections of labeled goals and propositions. Although it would be possible, for example, to select and permute the elements of the games in Table 1 to define new games, the resulting games would not resemble the conventions of actual language use.

**What attributes distinguish the games that occur from those that do not?**

Actual games have a kind of causal connectedness that arbitrarily composed games lack. In particular, the conventional conditions of actual games are such that if any of them does not hold, then achieving the illocutionary point of the game is prevented, made unlikely or rendered irrelevant. Similarly, the goals-of-R are such that if R does not pursue those goals, achieving the illocutionary point is prevented or made unlikely.

This causal connectedness makes it appropriate for a speaker to use a dialogue game to achieve some purpose for which a simple speech act would be inadequate. Because bidding of the game invokes its conventional conditions, and because the hearer can refuse or object on the basis of these conditions, games that are likely to fail are made likely to fail immediately. Games that can succeed can do so without explicitly mentioning the working hypotheses to be used while the game is in progress. These advantages of rapid failure and brevity in success can be used in

**explaining why only a few of the possible games occur, and in explaining why these games rather than others occur.<sup>7</sup>**

Notice also that games such as the Dispute game and the Permission Seeking game are typically useful in adversary situations, whereas others such as the Information Seeking and Helping games are typically useful in cooperative situations. This is reflected formally in that the illocutionary point and the goals-of-R differ in adversary games, but are identical in cooperative games.

For example, the Action Seeking game has eight conventional conditions, the first seven derived from the standard conventional conditions and the last from the special conditions of the game:

1. I wants R to cause A to be performed.
2. I believes that it is feasible for R to cause A to be performed.<sup>8</sup>
5. I has the right to ask R to cause A to be performed.
6. R has not already caused A to be performed.
7. R is willing to cause A to be performed.
8. R might not cause A to be performed in the normal course of events.

Clearly, in any use of the Action Seeking Game, brevity is achieved by not explicitly stating conditions 1 through 5; they are conveyed implicitly because they are conventional conditions of the Action Seeking Game. And rapid termination is achieved because if R is unable or unwilling to do A, has already done A, or is surely going to do A in any case, then the game can be terminated immediately by revealing that fact (conditions 3, 6, 7 and 8).

On the other hand, consider including in the Action Seeking game the condition of the Permission Seeking game stating that I does not have the right to perform A without the permission of R. This condition would be irrelevant and extremely inconvenient as a working hypothesis for the Action Seeking game. If it were expressed implicitly by bidding Action Seeking, it would often be necessary to explicitly deny it, a loss of brevity. If the condition did not hold, the

<sup>7</sup> There is a corresponding explanation needed in speech act theory of why certain sincerity conditions arise with certain illocutionary forces. For example, the act of S asserting P cannot have as a sincerity condition that S wants to know whether P is true, but a sincerity condition that S believes P is suitable. Notice that the same explanation can be used: the condition that S believes P has a direct causal connection to the illocutionary point that S wants H to know that S believes P, but the condition that S wants to know whether P is true does not.

<sup>8</sup> For this particular game, general condition 3 turns out to be identical to 2, and condition 4 is vacuous.

illocutionary point could still be achieved, so rapid termination would not be facilitated. Such games do not occur.

#### 9.0 SUMMARY

We have defined Dialogue Games as conventions of communication that can be used to account for the "episodic" structure of natural dialogue. Dialogue is two-party goal pursuit in which the parties choose to interact by communicating. The definition of Dialogue Games is based on an extension of speech act theory; several new speech acts are posited, including the act of bidding a dialogue game, an attempt to begin active use of a particular set of conventions.

The Conventional Conditions, which are part of every dialogue game, function in a way that somewhat resembles the function of sincerity conditions of a speech act: they are implicitly conveyed propositions invoked by use of the game. They differ from sincerity conditions in that their scopes of application include utterances by both participants, not just the single utterance by which they are invoked.

The principle of Motivational Coherence, which is a predicate applicable to whole dialogues, is based on relations between scopes of use of dialogue games. Motivational Coherence, with the more local notion of Motivational Compatibility, gives a principled basis for identifying certain utterances as non sequiturs, and for selecting the intended interpretation of an utterance from a set of meaningful candidates. Dialogue game theory can also be useful in accounting for speech act disambiguation, semantic range of generic terms, pronominal reference and perceived topic structure.

Bilateral conventions of interaction must be given theoretical status, since they contain relevant and otherwise unavailable information about how dialogue takes place. The dialogue games used most frequently have a causal connectedness that helps a speaker to satisfy his goals quickly.

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